REMARKS

Claim Rejections – 35 USC § 112

2. The Examiner rejected claim 11 because the meaning of the abbreviation P.I.D. is not supported in the specification. To overcome this rejection, the abbreviation P.I.D. has been changed to the full version of the same term, i.e. "proportional integrating derivative". It is submitted that both the abbreviation and the full term are well understood in the art. For example, both are used in US Patent 6,444,165 to Eckert mentioned on pages 1 and 8 of the specification of the present application (see Column 8, line 16 of Eckert). It will be noted that the teaching of Eckert is specifically incorporated into the present application by reference (page 8).

The Examiner rejected claim 18 for lack of an antecedent basis for "the trough lining" in the last line of the claim. To overcome this rejection, the final part of the claim has been amended to refer to metal leakage from the trough rather than metal infiltration into the trough lining. This wording is supported by the description on page 6 at lines 24 to 28.

Claim Rejections - 35 USC § 103

5. The Examiner rejected claims 1-3, 5-8, 10-11, 13-14 and 16-17 as unpatentable over Eckert (US 6,444,165) in view of Uhm et al. (US 6,257,023). Reconsideration of this rejection is requested for the following reasons.

As noted by the Examiner, Eckert fails to teach the use of a spaced air gap between the heating element and the trough body.

However, contrary to statements made by the Examiner, Eckert also places the heating elements in the trough body (layer 24 or side panels 26, 28 of Eckert) rather than in the insulating layer 20. It is believed that this confusion may arise because of the description of the use of the term "liner" for the element that is clearly equivalent to the "trough body" in the present application. Nevertheless, the "liner" of Eckert clearly forms the trough body which conveys and directs the molten metal. It will be appreciated that the "liner" of Eckert is equivalent to the trough body of the present application (see Col. 5, lines 49 to 57).

Eckert therefore heats the trough body from within its own walls by conduction rather than from the outside of the walls by radiation. Consequently, not only is there no mention of an air gap in Eckert, but there can be no air gap of the type required without a radical

re-design of the Eckert trough structure (positioning the heating element in the insulating layer rather than the trough body). This is not suggested in Eckert and, according to the drawings, would not be easy or practical as the thickness of the heating element is much greater than the apparent thickness of the insulating layer 20.

Indeed, to the following statement in Eckert teaches away from such a modification:

> *Using the liner heater of the invention has the advantage that no additional space is needed for heaters because they are placed in the liner. [Col. 7, lines 35 to 37]*

The Examiner cited Uhm et al. as teaching use of a spaced air gap G, stating that it would have been obvious to one having ordinary skill in the art to provide Eckert with the use of a spaced air gap between the heating element and the trough body shielded with a barrier graphite liner 12 as taught by Uhm et al. in order to effectively heat and deliver the molten metal being conveyed in the trough. Again reconsideration is requested.

It is to be noted that Uhm et al. relates to the production of glass fibers by drawing a fiber from a glass preform (P) or rod. A person skilled in the art of metal treatment would not likely consider looking at heating methods used for the fabrication of glass fibers as these fields of technology are unrelated. In such methods, the glass does not become truly liquid and it remains self-supporting throughout. Glass also has different chemical (and corrosive) behavior to molten metals.

The Examiner compares the trough (liner) of Eckert with the glass preform P of Uhm et al., but this is not a proper comparison. The preform P is not a container or channel member used for conveying a molten liquid. It is a solid rod that is heated until it becomes soft enough to form a fiber. The preform P must itself move through the furnace as glass is removed from it by the drawing operation. In short, Uhm et al. discloses a specialized "furnace" (Col. 1, lines 12 to 13) for heating a glass preform and drawing a fiber, and not, as in the present invention, a trough for conveying molten metal with means to prevent metal freeze during transit. The technologies are unrelated.

As noted, Uhm et al. does not have a liquid flowing through a trough body and a need to add heat to the liquid to keep it molten. Instead, Uhm et al. has a solid rod (preform) passing through a heated sleeve or liner to heat the solid to a point where a fiber can be drawn from it. There is an air gap G between the solid rod and the heated liner 12. However, if Uhm et al. and the present invention can be compared at all (which is denied), it would seem that the preform P of Uhm et al. is more like the molten metal of the present invention

(it is the material that is ultimately intended to be supplied with the heat), in which case Uhm et al. would be equivalent to having an air gap between the molten metal and the trough body in the present invention – an arrangement that is impossible to visualize. This also makes a combination of Uhm et al. with Eckert quite impossible to imagine.

In Uhm et al., the gap between the preform and the liner (having a maximum spacing of 7.5 mm – Col. 3, lines 58 to 59) is provided to deal with graphite particulate contamination and the formation of SiC (Col. 3, lines 58 to 65), which are not concerns (and cannot be concerns) in the present invention. The gap is not provided for heating efficiency or for prolonging heater life (as suggested by the Examiner) and there is nothing in Uhm et al. that would teach a person skilled in the art to provide a gap between the heater and the trough of a metal treatment container to achieve such an end. The improved thermal performance and heater life in Uhm et al. is attributed (Col. 3, lines 12 to 20) to the application of reflective coatings. In the present invention, the trough body facing the heater is desirably highly absorptive of radiation (not reflective) so, once again, Uhm et al. seems inconsistent with the present invention.

In short, to compare Uhm et al. with the technology of Eckert or the present invention is unreasonable. There is nothing in either Eckert or Uhm et al. that would lead a person skilled in the art to combine the teachings of these references, and such a combination would not anyway lead to a useful or effective result. Indeed, it is difficult to imagine how Eckert and Uhm et al. could be combined in any practical manner.

It is therefore believed that the present invention, as claimed in claims 1 and 13, and all claims dependent on the claims 1 and 13, should be regarded as patentable over Eckert and Uhm et al. considered either individually or in combination.

6. The Examiner rejected claims 4 and 15 as being unpatentable over Eckert in view of Uhm et al. and further in view of Rauch (US 5,908,066).

These claims are dependent from claims 1 and 13, respectively, and are therefore believed to be patentable for the same reason as these claims. Additionally, Rauch teaches the use of heater elements in the bottom of a melting furnace. The process of melting is different from that of maintaining a stable temperature in a metal transfer trough so that one would not immediately assume that heaters mounted underneath the trough body would necessarily provide the desired level of temperature control for flowing metal.

7. The Examiner rejected claim 9 as being unpatentable over Eckert in view of Uhm et al. and further in view of Darnfors (US 5,126,107). This claim is dependent indirectly from claim 1 and is therefore believed to be patentable for the same reason as these claims. Additionally, Darnfors teaches an Fe-Ni-Cr alloy having good oxidation resistance and strength. The Examiner appears to believe that these properties are the ones that a person skilled in the art would be seeking for the present invention, but this is not the case. In the present invention, the alloy is used in a metal intrusion barrier and a skilled person would be looking for a material that would impede the passage of molten metal. There is nothing in Darnfors to suggest that selection of this alloy would meet this requirement.

8. The Examiner rejected claims 12 and 18 as being unpatentable over Eckert in view of Uhm et al. and further in view of Yamura et al. (US 4,556,202). These claims are dependent directly or indirectly from claims 1 and 13, respectively, and are therefore believed to be patentable for the same reason as these claims.

Additionally, Yamura et al. teaches the use of a metal intrusion sensor. The Examiner suggests that the sensor of Yamura et al. functions in the same manner as that of the present invention. A closer reading of the description of Yamura et al. (Col. 2, line 43 and following) reveals a disclosure of two forms of sensor based on a wire placed near the location where a leak is likely to occur. The resistance of the wire changes if it is contacted by metal (e.g. the wire is cut) and this change is sensed by the outside circuit, or if metal penetrates the surrounding material, the wire becomes hotter and the increase in wire temperature is sensed (as a change in resistance). In neither case is the current flow between the metal and the intrusion barrier measured as a sensor response.

The section in Col. 5, line 14 to 22 may have lead the Examiner to a different interpretation. This section, if carefully read, teaches that a temperature/level sensor 16 can be used and connected to the same control unit as the leakage sensor. The sensor 16 is specifically surrounded by a closed end protective refractory tube so that the combination of sensor 16 and wire 6 could not form a closed circuit to detect metal penetration in the manner of the present invention. Therefore, the Examiner's interpretation is incorrect. Although the wording of this section, in particular the last sentence, is ambiguous, when the description is read in full, there is only one interpretation.

Addition of New Claims

New dependent claims 19 to 22 have been added to provide further definition of the invention.

As shown in Fig. 2 of the drawings of the present application, there is provided in the air gap between the heating unit 20 and the trough body 16. In Fig. 3, a metal intrusion barrier is provided in the air gap, but it does not block the desired radiative heating of the trough body by the heating unit. In this latter regard, claim 7 has also been amended to define the metal intrusion barrier as a mesh or porous sheet (see the description of Fig. 3 on page 6 of the disclosure).

In view of the amendments and arguments provided above, favorable reconsideration of this application is requested.

Respectfully,

Christopher C. Dunham

Christopher C. Dunham
Reg. No. 22,031
Attorney for Applicants
Tel. (212) 278-0400

I hereby certify that this paper is being deposited this date with the U.S. Postal Service as first class mail addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Christopher C. Dunham

Christopher C. Dunham, Reg. No. 22,031

Date JAN. 10, 2005